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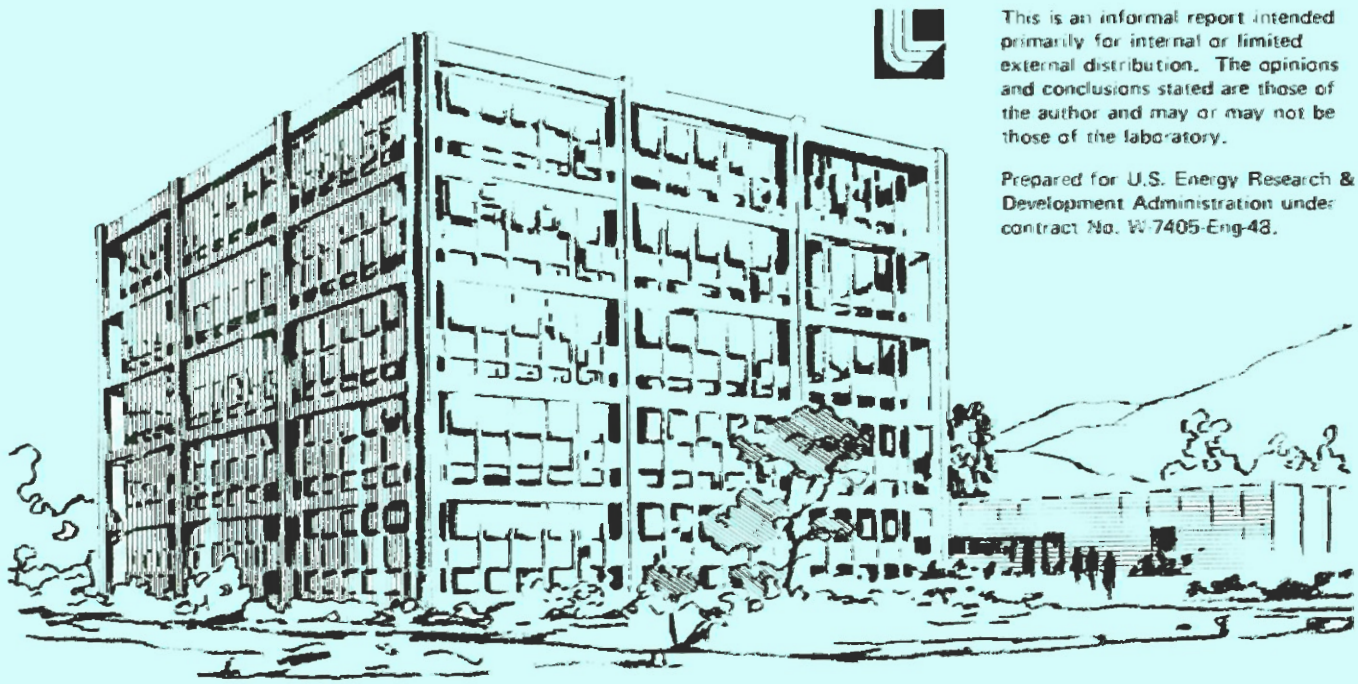
Lawrence Livermore Laboratory

HYDROGEOCHEMICAL AND STREAM-SEDIMENT SURVEY OF THE NATIONAL URANIUM RESOURCE EVALUATION (NURE) PROGRAM — WESTERN UNITED STATES

Quarterly Progress Report
January through March 1977

June 1, 1977



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ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
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ERDA

NEWS
RELEASE

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ERDA ISSUES JANUARY-MARCH 1977 WESTERN UNITED STATES HYDROGEOCHEMICAL/STREAM SEDIMENT QUARTERLY REPORT

The Grand Junction (Colorado) Office, Energy Research and Development Administration (ERDA), has placed on open file a quarterly progress report entitled "Hydrogeochemical and Stream-Sediment Survey of the National Resource Evaluation (NURE) Program - Western United States," dated January-March 1977.

The report, prepared by ERDA's Lawrence Livermore Laboratory (LLL), Livermore, California, summarizes the progress of the survey being conducted by LLL in Arizona, California, Idaho, Nevada, Oregon, Utah, and Washington. During the quarter, a reconnaissance sampling project was completed in west-central Utah (833 sites) and another started in southern Nevada and southeastern California (1,500 sites).

NURE is an ongoing program of ERDA's Grand Junction Office which includes the development and compilation of geologic and other information with which to assess the magnitude and distribution of uranium resources and determine areas favorable for the occurrence of uranium in the United States. LLL is operated for ERDA's San Francisco Operations Office by the University of California.

The 15-page report, GJBX-53(77) [LLL No. UCIB-16911-77-1], has been placed on open file at the following locations:

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HYDROGEOCHEMICAL AND STREAM-SEDIMENT SURVEY OF THE NATIONAL URANIUM RESOURCE EVALUATION (NURE) PROGRAM — WESTERN UNITED STATES

Quarterly Progress Report

January through March 1977

ABSTRACT

During this quarter, we have completed a reconnaissance sampling project in west-central Utah (833 sites) and started another in southern Nevada and southeastern California (1500 sites). Planning and site selection have begun for a sampling project covering a 150,000-km^2 (58,000-mi^2) area in Nevada, California, and Utah. Contracts for about 5000 of the sites in this area will be granted in the next few months.

New office, laboratory, and sample storage facilities at LLL are now in use. We have installed a delayed-neutron counter and an instrumental neutron-activation analysis system in our automated sample analysis facility. A plasma-source, optical-emission spectrometer has also been installed and will be fully operational next quarter. Several improvements have been made in computer programs to facilitate data acquisition, analysis, storage, and open-file reporting. Software development and calibration work are continuing, and the facility should be ready for full-scale operation (27,000 samples per year) sometime next quarter.

INTRODUCTION

This report summarizes the progress of the Hydrogeochemical and Stream-Sediment Reconnaissance (HSSR) survey being conducted by the Lawrence Livermore Laboratory (LLL) in support of the National Uranium Resource Evaluation (NURE) Program. The NURE Program is administered by the Grand Junction Office of the U.S. Energy Research and Development Administration.

The LLL study is part of a systematic nationwide investigation by ERDA of the uranium distribution in surface and underground waters and in stream sediments. The overall objective is to identify favorable areas for uranium exploration. Included in the LLL portion of this study are seven western states (Arizona, California, Idaho, Nevada, Oregon, Utah, and Washington). Similar reconnaissance surveys are being conducted in the rest of the continental United States (including Alaska) by the Los Alamos Scientific Laboratory, the Oak Ridge Gaseous Diffusion Plant, and the Savannah River

Laboratory. The primary contacts for the LLL portion of the NURE program are listed in Appendix A.

HIGHLIGHTS

- The Beryllium Belt I reconnaissance sampling project in west-central Utah has been completed.
- A reconnaissance sampling project in southern Nevada and southeastern California (Southern Nevada I) began in early March and will be completed by mid-April 1977.
- Planning and site selection have been completed for the Southern Nevada II reconnaissance sampling project. The subcontractor will be selected in April 1977.
- Planning and site selection are in progress for the Beryllium Belt II reconnaissance sampling project scheduled to start in June 1977.
- Planning and site selection have begun for the Pioche 41,400-km^2 (16,000-mi^2) and Eastern Sierra 52,000-km^2 (20,000-mi^2) reconnaissance sampling projects.
- The Great Basin groundwater sampling program in Nevada and adjacent states is continuing on schedule.
- Planning and site selection have begun for three orientation studies in Arizona scheduled to start in mid-May 1977.
- The high-throughput instrumental neutron-activation analysis system has received extensive development effort during this quarter. It will be ready for full-scale operation next quarter.
- New office and laboratory facilities have been completed and occupied.
- Improvements have been made in information management systems to permit timely publication of "raw data" reports in a standardized format.
- Four papers were presented at the Symposium on Hydrogeochemical and Stream-Sediment Reconnaissance for Uranium in the United States, Grand Junction, Colorado, March 16-17, 1977.

GEOLOGY AND SAMPLE ACQUISITION

Reconnaissance Sampling Program

Beryllium Belt I

During January and February 1977, we conducted a reconnaissance sampling project in west-central Utah. The area covered is shown in Fig. 1. The part of the study area within the U.S. Army Dugway Testing Grounds was sampled by LLL geologists, but the remaining samples (including water and dry sediments) were taken by contract geologists. The samples were taken from 833 sites over an area of 20,000 km^2 (7747 mi^2). This comes to about one site per 24 km^2 (9.3 mi^2). However, if we adjust for the fact that there was very low-density coverage within the Great Salt Lake Desert, the actual density was about one site per 13 km^2 (5 mi^2). Dry sediment samples were supplied at a cost to us of $9.22 per site. Groundwater samples were collected by a team from the Desert Research Institute (DRI), Reno, Nevada. A quality assurance program, consisting of revisits and resampling of approximately 5% of the sites, was conducted by LLL geologists.

Southern Nevada I

A reconnaissance sampling program in southern Nevada and southeastern California began in early March and will be completed by mid-April 1977. The area covered is shown in Fig. 1. The contractor will collect a total of 1408 dry-sediment samples, including samples from 79 sites along the Nevada-Arizona portion of the Colorado River. The cost will be $9.11 per dry site and $15.00 per river site. Concurrent with the dry-sediment sampling, DRI is sampling ground water at 40 sites. The total project area covers 23,300 km^2 (9000 mi^2), and the average sample density will be one per 16 km^2 (6.2 mi^2). A quality assurance program, consisting of site visits and resampling, will be conducted by LLL geologists.

Southern Nevada II

Planning and site selection have been completed for a reconnaissance sampling program in southern Nevada and southeastern California (directly north of the Southern Nevada I project area). This project falls in the Basin and Range Province, which consists primarily of elongated north-trending ranges separated by wide alluvial basins. Figure 1 shows the extent of the sampling area, which covers most of the Death Valley and Las Vegas National Topographic

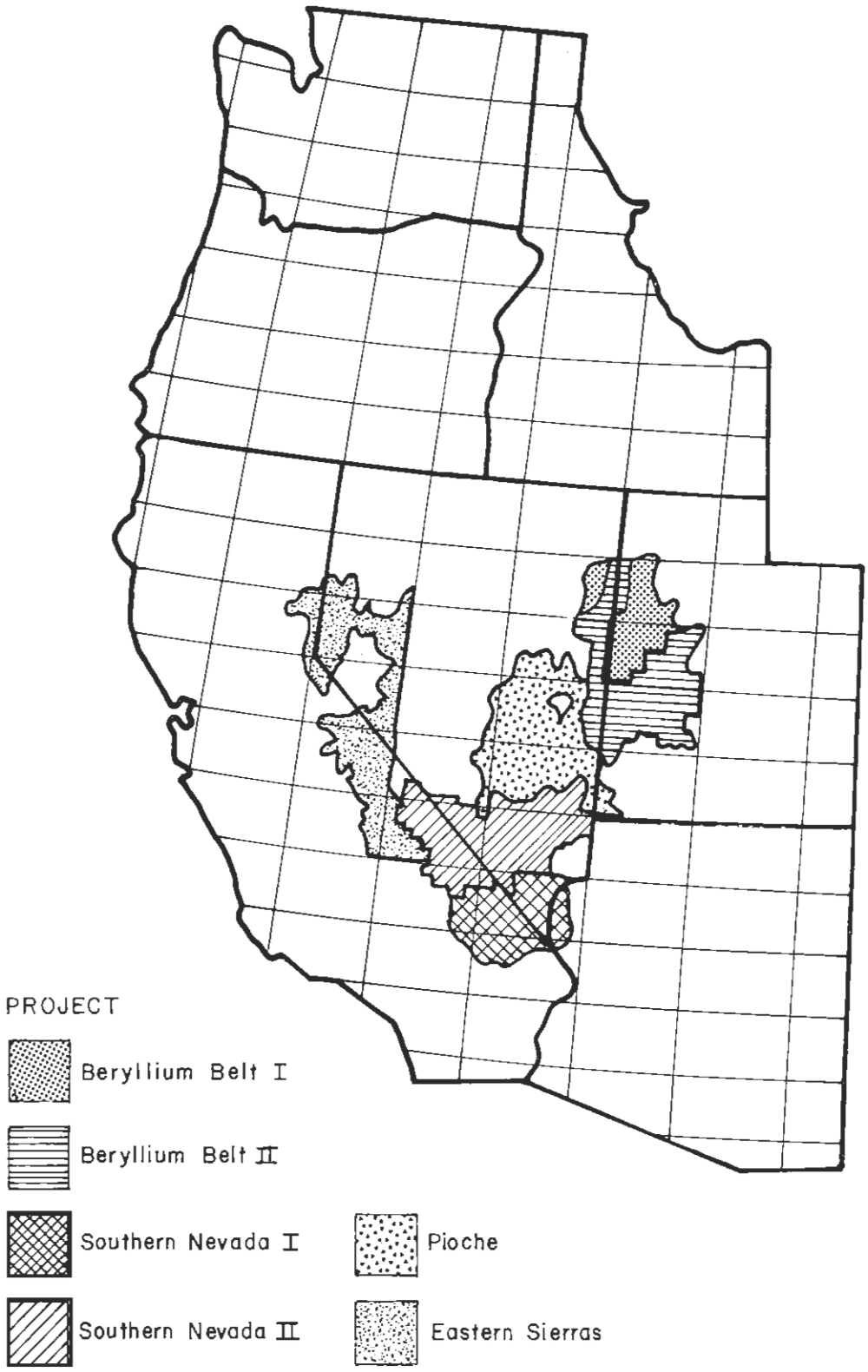

Fig. 1. Regional reconnaissance projects.

Map Service (NTMS) sheets and parts of the Goldfield, Caliente, Trona, and Kingman sheets. The Death Valley National Monument will be included in this project. For the most part, the area is characterized by interior drainage, with ephemeral rivers ending in playa lake sinks. However, in the extreme eastern part of the project, rivers and streams drain into the Colorado.

Igneous, metamorphic, and sedimentary rocks ranging in age from Precambrian to Holocene are exposed. Granitic rocks and pegmatites of Precambrian and Mesozoic age intrude older sedimentary units, particularly in the western part of this area. Tertiary volcanics are widely exposed as well. Parts of the area are heavily mineralized. Metals of economic importance here are zinc, lead, copper, gold, silver, and manganese. Nonmetallic minerals being mined include gypsum, fluorspar, and various borates. Uranium mineralization associated with copper and lead has been observed near the Goodsprings district.

Sampling sites have been selected, and a request for bids has been mailed out. Bids will close on April 3, 1977. A total of 2150 sites (both wet and dry) covering an area of 32,000 km^2 (12,500 mi^2) will be taken. This will provide an average site density of about one per 15 km^2 (5.8 mi^2). Groundwater samples will be taken by DRI.

Beryllium Belt II

The area to be sampled in this project lies generally south of the previously sampled Beryllium Belt I project and includes areas east and west of the former project at relatively high elevations not accessible in February 1977. The area covered is shown in Fig. 1.

This region is part of the Basin and Range Province, which is characterized by normal faulted mountain blocks separated by alluvial valleys. The exposed rocks consist of Precambrian metamorphic, Paleozoic and Mesozoic sedimentary, Tertiary volcanics, and intrusive igneous rocks of several ages. In the northern ranges, Paleozoic sedimentary rocks are locally capped by Tertiary volcanics. To the south, the Tertiary volcanics thicken and cover the prevolcanic rocks.

Planning and site selection started this quarter. Current plans call for the sampling of approximately 23,300 km^2 (9000 mi^2) covering most of the Richfield NTMS sheet and parts of the Lund, Delta, and Ely sheets.

Pioche

Planning and site selection were begun this quarter for the Pioche project, which will cover some 41,400 km^2 (16,000 mi^2) in Nevada and Utah. The study area, shown in Fig. 1, includes most of the Caliente and Lund NTMS sheets and portions of the Ely, Tonopah, Goldfield, and Cedar City sheets. The region is entirely in the Basin and Range Province. Previously determined sampling techniques that are appropriate for this region will be employed.

Eastern Sierra

This project consists of approximately 52,000 km^2 (20,000 mi^2) and covers mainly the east-draining slope of the Sierra Nevada mountains. The area covered ranges from 36°N to 40°N latitude encompassing portions of the Death Valley, Mariposa, Walker Lake, and Reno NTMS sheets. lt is shown in Fig. 1.

The rocks in this area are chiefly quartz-bearing intrusives, which range in composition from quartz diorite to alaskite, but which include smaller masses of more mafic plutonic rocks and remnants of metamorphosed sedimentary and volcanic rocks.

The project area also includes the terminal desert basins into which the Sierra waters drain. The rocks on the east side of the Sierras are mainly Paleozoic sediments and Tertiary volcanics. Samples around the terminal basins will consist mainly of dry sediments. ln the Sierras most of these samples will be water samples and wet sediments (drought notwithstanding).

Planning and site selection for this project were begun during this quarter and call for approximately 2500 sample sites, of which about 30% will be water and wet sediment sites.

Great Basin Groundwater Program

Sampling of well and spring waters in Nevada and adjacent states in the Great Basin is being conducted under contract by DRI. This is an ongoing contract, and sampling in each area is timed to coincide with the reconnaissance sampling of surface materials by contract geologists. Dr. Roger Jacobson is the technical contact at DRI.

Orientation Studies

Northern Rocky Mountain Province

Particle size studies on stream sediments collected in the Washington and Idaho areas were continued this quarter. Trace-element analyses were completed, and statistical analysis of the data continues. Petrologic studies are planned for the immediate future.

Plans were made to resample sites during the high run-off period (May 1977), and arrangements were made to meet with Wayne Moen and Eric Schuster of the Washington State Division of Natural Resources and Geology to discuss the Washington stream sediment survey.

Additional samples of whole rock and splits of the crushed whole rock from Mesozoic intrusives collected by Bendix Field Engineering Corporation (Spokane Office) as a part of their Northeastern Washington/Northern Idaho Plutonic Rocks study have been acquired. This brings the total to 25 samples received. Characterization of these samples should commence in June 1977.

Arizona Orientation Study

Planning and site selection were begun for three separate orientation studies in different geological environments in Arizona. The first will be the Artillery Peak basin, northwest of Wickenburg. This 580-km^2 (225-mi^2) area contains numerous cases of uranium mineralization in Tertiary sedimentary rock units. Approximately 200 dry sediment samples and 10 water samples will be taken. The second phase of the project will study uranium mineralization in crystalline rocks. This 520-km^2 (200-mi^2) area centers in the Santa Rita Mountains southeast of Tucson. Approximately 100 dry sediment and 50 water samples will be taken. The last phase of the project will center in the Sierra Ancha region of the Tonto National Forest. This is an area of vein mineralization in Precambrian rocks. The 390-km^2 (150-mi^2) area contains about 100 sample sites. The first phase of this project is scheduled to begin in mid-May 1977.

Nevada Groundwater Monitoring Program

The Desert Research Insitute began sampling 12 well and spring sites in Nevada this quarter. The contract calls for sites to be sampled every two months. These samples will be analyzed at LLL for a number of elements and radioelements.

SAMPLE PROCESSING AND ANALYSIS

Analytical Processing

During this quarter, analyses of samples from the Nevada playa orientation study were completed. Using our instrumental neutron-activation analysis system, we analyzed the smallest particles (<150 μm) from samples for which the 500- to 1000-μm size fraction had already been analyzed. These tests should tell us more about wind-blown material present at dry-sediment sampling sites. We also processed a number of size fractions from wet sediments collected in the northeast Washington orientation study. These results will be used to determine which size fractions to examine in our general analyses of the orientation study samples from this area.

The above tests exhausted our backlog of prepared dry samples, and further sediment processing will be delayed until the processing laboratory is fully equipped and staffed. Contracts for sample processing have not been issued because of funding limitations.

A modified Technicon AutoAnalyzer has been used in analyzing water samples for chloride and sulphate. Approximately two-thirds of the backlog of water samples have now been analyzed.

Developing Analytical Capability

Several analytical systems, instruments, and facilities have been assembled for use in analyzing the large number of samples that will be collected. Program operations have been moved to the LLL Reactor Building and laboratories have been modified to facilitate operations and automation of analytical systems. Automated systems are needed to meet the projected throughput requirements. Detailed descriptions of these systems have been included in previous progress reports. We will describe below the significant developments occurring during the last quarter.

The high-throughput instrumental neutron-activation analysis system (HT-INAA) continues to receive extensive development effort. Essentially all hardware components have been installed and have received functional check-outs. Our electronics support staff is now wiring and checking out the auxiliary systems. The rabbit transport system has been completed, although some minor modifications from the original design have been necessary. The Y joints have been replaced so as to minimize direction change in transit and reduce rabbit wear. The rabbit design has been modified to provide extra

threads for the end cap. This gives an extra margin of insurance against separation. We noticed that the runners on the aluminum switch plates were showing signs of wear, even during the checkout phase, so we replaced them with stainless steel runners.

Our lithium-drifted germanium gamma-ray detectors have been installed and calibrated. Spectra have been successfully collected in the microprocessors and unloaded through the master control processor to our interim data-transfer system. The latter, a borrowed minicomputer with cartridge disk output capability, will be replaced with magnetic tape when an interface to the microcomputer becomes available. Transfer of the data from cartridge disk to the LLL computer center requires a manual read and magnetic tape write using a stand-alone minicomputer system. This transfer mechanism has been developed and checked out. Work was begun on the repacking codes necessary to format input run data and gamma spectra for processing by the large computers. We expect to have complete data-processing capability in the HT-INAA system during the next quarter.

Considerable progress has been made on transfer system check-out and debugging, as well as on the rabbit control coding. Transport, switching, and photosensor tests have been conducted. At the end of the quarter, the coding that will make automatic operation on preset schedules possible was in the preliminary check-out stage. We expect to install the irradiation facility in the reactor during May, when the transport control codes are completed. At that time, manual-mode irradiation and data processing capability will begin for purposes of system calibration and experimentation. We estimate that fully automated operations will begin late in the next quarter.

The delayed-neutron counter has been fitted with its electronics packages and installed in a cased hole along the north wall of the reactor building. Preliminary checks indicate that it will provide at least an order of magnitude improvement in sensitivity compared to our previous system. Largely because of reduced counter size and improved shielding, the background count rate is now only 14 cpm. Thus, nanogram quantities of uranium should be easily detectable.

We received the direct-reading spectrometer system for the NURE program on January 14, 1977. The instrument was placed in the NURE clean room (room 1164) in Bldg. 281 on January 20th. Initial installation procedures were performed by a Jarrell-Ash engineer from January 25 through January 27.

In early February, water lines, air lines, and an exhaust hood were installed by LLL personnel for connection to the instrument. During February and early March, we familiarized ourselves with the instrument and with program writing. It was obvious that the inductively coupled plasma (ICP) system was not operating as well as it should. Poor sample nebulization, misalignment of analytical exit slits, and electronic malfunctions resulted in poor sensitivity and precision in tests run during this period.

The factory representative returned on March 10. During numerous trips to LLL over the ensuing weeks, he spent much time correcting deficiencies and optimizing the instrument. Changes in the nebulizer and torch were made. The analytical channels were aligned. A few photomultiplier tubes were replaced. Some closely-packed spectrometer exit slit hardware was worked on. A broken lead in the dc arc source was repaired, and various circuit boards in the central processing unit were tested.

We have interfaced our AutoAnalyzer with a minicomputer to provide on-line data collection and processing capability for chloride and sulphate analyses. This system provides the interface for operator set-up, operation, and modification of analyzer functional parameters, collects and reduces the data, and prepares an analytical report. Currently the output data is key-punched for data-base transfer. We plan to provide some form of computer-readable output reports as a second generation modification during FY 78.

Sample preparation and receiving facilities have been complete. Our sediment processing laboratory is operating, although at a less-than-optimum rate because of manpower limitations. This facility will be staffed early next quarter. Our clean-room laboratory is complete but not activated. Once the emission spectrometer is set up and checked out, we will perform clean-up operations to improve the working environment. Currently, we are operating as a controlled-access laboratory. Clean room procedures are not being enforced.

INFORMATION MANAGEMENT AND REPORTING

Site Data Acquired

Field data from approximately 2350 site visit forms were added to our site data base during this quarter. The data were collected in the Humboldt River (Nevada) and Six Basins (Nevada) reconnaissance projects and in the

Washington orientation study. A few more forms from the ground-water phase of the Humboldt River and Six Basins projects remain to be keypunched. After all the records are stored, traveler cards will be prepared to accompany the sample packages through processing. Site Visit Forms from the Beryllium Belt I project have been received and are being keypunched.

All of the field data and the digitized site locations for a given project are to be assembled first in the site data base. Later, the analytical data and site data will be combined in an archival data base, which will serve as the source of information for open-file reports.

Data Base Improvements

During this quarter, we have worked to streamline input/output procedures for our data base. The layout of the Site Visit Form, on which field data is recorded, has been simplified to faciiitate accuracy and speed in field use and in keypunching (see Appendix B). Site Visit Form proofreading and verification procedures have also been refined. An improved preprocessor is used to enter site records into the data base. Site locations, taken from the field maps as UTM coordinates, are transferred from the digitizing table to the computer via a magnetic tape cartridge. Procedures for converting the UTM coordinates to latitude and longitude and for entering them into the data base are nearly complete. UTM site coordinates are used to create the master copies for the location and symbol-value overlays; in latitude/longitude form they become part of the ERDA sample number. The data bases containing field information from the early orientation studies (Walker Basin, Winnemucca, Smoke Creek, Cave Valley, and Roach Lake) have been converted to the coding and formats presently in use.

The format of internal reports summarizing field data from the various projects has been decided upon. In addition to the field data, the reports will contain statistics on the number of sample packages of various types collected. The reports will be distributed to the geologist for review and reference and to the analysis group for use in planning sample processing. The data will be organized on the basis of site type. All field data from river sites will be in one section, all lake site data in another, and all spring site data in another. The reports will be made available in microfiche and printed form. A prototype internal report on the Washington orientation study has already been issued.

As samples from a given project are analyzed and the results delivered to the data management group, the data will be collected into the analysis data base. When all of the samples from that project have been analyzed and the data stored, the appropriate field data will be added to the analysis record. At this point the data base becomes archival and contains all of the computer-stored information relevant to that project. The archival data base can then be called upon to output files for data analysis, mapping, or reports.

The format of the archival data base has recently been expanded to accommodate special chemistry measurements, the field data base, and more inputs from the emission spectrometer.

Publications

The following papers were presented at the Symposium on Hydrogeochemical and Stream-Sediment Reconnaissance for Uranium in the United States, Grand Junction, Colorado, March 16-17, 1977:

- Kenneth Puchlik, *Collection and Preparation of Wet and Dry Stream-Sediment Samples*, Lawrence Livermore Laboratory, Rept. UCRL-79240 (1977).
- T. L. Steinborn, *Description of Quality Assurance in the HSSR Program and Summary of Analytical Methods Used*, Lawrence Livermore Laboratory, Rept. UCRL-79242 (1977).
- David L. Leach, Jr., *Geochemical Reconnaissance for Uranium in the Arid Regions of the Western United States*, Lawrence Livermore Laboratory, Rept. UCRL-79241 (1977).
- Joseph F. Tinney, *The Hydrogeochemical and Stream-Sediment Reconnaissance Program at the Lawrence Livermore Laboratory*, Lawrence Livermore Laboratory, Rept. UCRL-79243 (1977).

APPENDIX A. PRIMARY CONTACTS FOR THE LLL PORTION OF THE NURE SURVEY.

Name	Responsibility	Mail stop	Phone ext.
K. Street, Associate Director, Energy & Resource Programs	Principal laboratory contact for NURE Program	L-209	8301
J. Tinney, Radiochemistry staff	Program leader	L-540	5321
D. Leach, Earth Sciences staff	Geology and geochemistry	L-540	5321
R. Lake, Mechanical Engineering staff	Operations, contracts, and field support	L-540	5321
C. Smith, Radiochemistry staff	Sample analysis	L-540	5321
S. Grotch General Chemistry staff	Information management and reporting	L-404	7957
B. Gumm, Computations staff	Data-base management	L-307	3400

Name of Primary Contact (L-)
Lawrence Livermore Laboratory
P.O. Box 808
Livermore, California 94550

Telephone: (415) 447-1100 + extension

APPENDIX B. REVISED LLL SITE VISIT FORM.

UCLLL SPECIFICATION UHS001

LLL HYDROGEOCHEMICAL SITE VISIT FORM

(PLEASE PRINT)

Site No. _____ (73-80)

Site Visit Identification

Col. 1&2

01 Project: _____ (10) Team: _____ (40)

02 Township-Range Owner: _____ (40)

03 Section, 1/4 Section: _____ (10) Address: _____ (40)

04 _____ (40)

05 Map Name: _____ (10) _____ (40)

06 Date: _____ (10) Time: _____ (40)

Samples Collected (Enter Sample Type, Treatment)

07	S1 _____ (10)	S5 _____ (20)	S9 _____ (30)
08	S2 _____ (10)	S6 _____ (20)	S10 _____ (30)
09	S3 _____ (10)	S7 _____ (20)	S11 _____ (30)
10	S4 _____ (10)	S8 _____ (20)	S12 _____ (30)

Field Data (All Water Sites)

11	Temperature (°C)	_____ (10)	Phosphate (mg/ℓ)	_____ (40)
12	Specific Conductivity		Nitrate (mg/ℓ)	_____ (40)
13	(μmhos/cm)	_____ (10)	Ammonia (mg/ℓ)	_____ (40)
14	pH	_____ (10)	Other	_____ (40)
15	Total Alkalinity (mg/ℓ)	_____ (10)		_____ (40)
16	Phenal. Alkalinity (mg/ℓ)	_____ (10)		_____ (40)
17	CO_2 (mg/ℓ)	_____ (10)		_____ (40)

Ground Water, Lakes

18 Eh (mv) _____ (10) Dissolved Oxygen (ppm) _____ (40)

Stream Water and Sediment

19 Stream Width (nearest ft.) _____ (10) Depth (nearest ft.) _____ (40)

20 Water Level: Dry _____ (10) Low _____ (11) Normal _____ (12) High _____ (13) Flood _____ (14)

21 Evidence of Wind Blown Material at Sample Site: Yes _____ (10) No _____ (11) Not Sure _____ (12)

22 Nature of Bottom: Rock _____ (10) Gravel _____ (11) Sand & Gravel _____ (12) Sand _____ (13) Silt _____ (14)

23 Refuse or other contamination visible _____ (10)

24 Precipitate or Stain: Fe hydroxides _____ (10) Mn hydroxides _____ (11) Organic _____ (12)

25 Sulphur _____ (10) Sulfides _____ (11) None _____ (12)

26 Vegetation: Sparse _____ (10) Moderate _____ (11) Heavy _____ (12) Forest _____ (13)

27 Odor: Hydrogen Sulfide _____ (10) None _____ (11)

28 Color of Sediment: Black _____ (10) Gray _____ (11) Brown _____ (12) Dark Brown _____ (13) Red _____ (14)

29 Red Brown _____ (10) Yellow _____ (11) Yel. Brown _____ (12) Buff _____ (13) White _____ (14)

30 Suspended Matter: Heavy _____ (10) Light _____ (11)

31 Relief: High _____ (10) Medium _____ (11) Low _____ (12) Flat _____ (13)

32 Weather: Clear _____ (10) Cloudy _____ (11) Light Rain _____ (12) Moderate Rain _____ (13) Heavy Rain _____ (14)

33 Evidence of Recent Rain _____ (10)

34 Activity in Area: Industrial _____ (10) Farming _____ (11) Mining _____ (12) Residential _____ (13)

35 None _____ (10)

Revised LLL Site Visit Form (continued).

For Wells Only

36 Well Type: Municipal $_{10}$ Domestic $_{11}$ Farm/Livestock $_{12}$ Irrigation $_{13}$

37 Well Location: $_{10}$

38 Casing: Iron $_{10}$ PVC $_{11}$ Galvanized Iron $_{12}$ Other $_{13}$

39 Depth of Well (ft.) $_{10}$

40 Discharge Type: Artesian $_{10}$ Non Flowing $_{11}$ Wind $_{12}$ Gas/Elect. Pump $_{13}$

41 Hand Drawn $_{10}$ Other $_{20}$

42 Discharge Rate (gal/min) $_{10}$

43 Odor: Hydrogen Sulfide $_{10}$ None $_{11}$ Other $_{20}$

For Springs Only

44 Type: Hot $_{10}$ Cold $_{11}$ Undeveloped $_{12}$ Developed $_{13}$

45 Use: Domestic $_{10}$ Livestock $_{11}$ None $_{12}$ Other $_{13}$

46 Odor: Hydrogen Sulfide $_{10}$ None $_{11}$ Other $_{12}$

47 Precipitate of Stain: Fe hydroxides $_{10}$ Mn hydroxides $_{11}$ Organic $_{12}$

48 Sulphur $_{10}$ Sulfides $_{11}$ None $_{12}$

49 Evidence of Degasing: Yes $_{10}$ No $_{11}$

50 Evidence of Mineral Precipitation: Yes $_{10}$ No $_{11}$

51 Discharge Area ($ft.^2$) $_{10}$ Discharge Rate (gal/min) $_{20}$

For Lakes/Reservoirs

52 Type: Natural Lake $_{10}$ Man-Made Lake $_{11}$ Pond $_{12}$ Other $_{20}$

53 Sample Taken: Shore $_{10}$ Middle $_{11}$ In-flow $_{12}$ Out-flow $_{13}$ Other $_{20}$

COMMENTS: _____

LL 4855

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